SHIMIZU et al. 5,854,316, or Japanese Patent Nos. 8-253555, 10-182941, or 9-208808.

Reconsideration and withdrawal of the rejection are respectfully requested for the following reasons:

As to European Patent No. 915,118, applicants claim priority from Japanese Application 10-299606 filed October 21, 1998. A verified English translation of the foreign priority application is submitted herewith to perfect the claim of priority. Since the Japanese filing date precedes the May 12, 1999 publication date of EP 915,118, EP 915,118 cannot be used as a prior art reference.

As to SHIMIZU et al., column 4, lines 8-16, for example, disclose that in order to fulfill the objection of good flame retardance, the content of the organic filler (C) in the epoxy resin compound should be 70-97 wt% and their inorganic filler (C) should contain 0.1-50 wt% of alumina.

Specifically, column 9, lines 42-50 disclose that when the amount of inorganic filler (C) is less than 70 wt%, or in the case where no alumina is used even though the amount of the inorganic filler (C) is more than 70 wt%, the epoxy resin composition would be poor in flame retardance. See also the comparative examples 1, 2, 4, and 6 in Tables 1 and 2 of SHIMIZU et al.

Claims 14-43 of the present application do not require alumina to fulfill the object of good flame retardance. Since

SHIMIZU et al. require the addition of alumina in 0.1 to 50 wt% SHIMIZU et al. do not anticipate Claims 14-43.

As noted in the Official Action, page 20, lines 7-8 of the present application disclose alumina powder as a possible inorganic filler. Alumina is neither used in the preferred embodiments nor specifically recited. SHIMIZU et al. only disclose alumina. SHIMIZU et al. do not offer alternatives to the alumina. Absent impermissible hindsight reasoning, one of ordinary skill in the art would not be motivated to use other than the alumina disclosed by SHIMIZU et al. Only after reading the present specification would alternatives to alumina, such as fused silica powder or crystalline silica powder, be taught as examples of inorganic fillers that may be used for semiconductor capsulating resins.

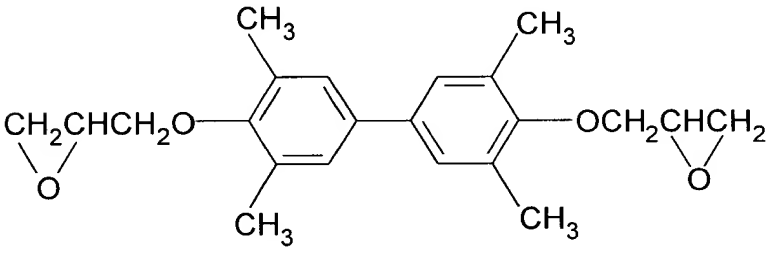
In addition, SHIMIZU et al. teach an inorganic filler having 70-97 wt%, not $30 \leq W \leq 60$ wt% as recited in claim 14. Further, SHIMIZU et al. teach a phenolic resin having an hydroxyl group, not that the phenolic resin has no hydroxyl group as recited in claims 26, 30, and 34.

JP '555 teaches an epoxy resin composition having 0.3 wt% or less of permitted compound as a flame retardant, and 0.3 wt% or less of antimony compound as a flame retardant auxiliary. JP '555 does not disclose or suggest that the other composition

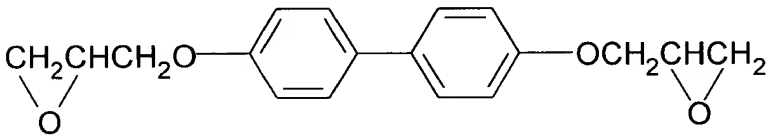
comprises no flame retardant material nor flame retardant auxiliary, as recited in each of independent claims 14, 26, 30, and 34 of the present application.

In addition JP '555 teaches an inorganic filler having 87-98 wt%, not $30 \leq W \leq 60$ as recited in claim 14. Further, JP '555 teaches a phenolic resin having a hydroxyl group, not that the phenolic resin has no hydroxyl group as recited in claims 26, 30, and 34.

Typically, epoxy resin compositions of examples 1 to 11 of JP '555, as listed in Table 2 on page 8, comprise a mixture of biphenyl epoxy resin of formula (I) and tetramethylbiphenyl epoxy resin of formula (II) as (A) epoxy resin:



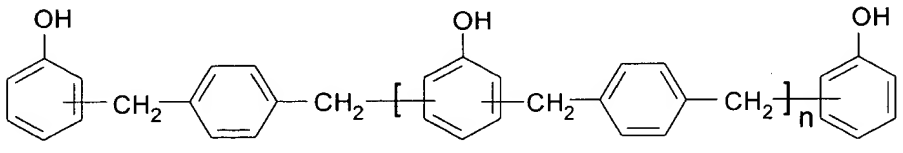
(I)



(II)

,

an aralkylphenol resin as (B) curing agent (phenolic resin):



(III)

wherein n is 0 or more, its OH eqivalent: 175g/eq., and 90 wt% or more of (C) fillers (inorganic fillers).

JP '941 discloses that in order to fulfill the object of good flame retardance, the content of the inorganic filler (C) in the epoxy resin compound should be 70-97 wt% and the inorganic filler (C) should contain 0.1-20 wt% of alumina therein, or the content of the inorganic filler (C) in the epoxy resin compound should be 87-97 wt% and the inorganic filler (C) should contain 0.1-50 wt% of alumina therein, as disclosed at column 7, lines 1-9. As seen in comparative examples 1,2, or 4 in Tables 1 and 2 of JP '941, where the amount of inorganic filler (C) is less than 70 wt%, or in the case where no alumina is used even though the amount of the inorganic filler (C) is more than 70 wt%, the epoxy resin composition would be poor in flame retardants.

JP '941 only offers alumina as an inorganic filler. Absent impermissible hindsight reasoning, one of ordinary skill in the art would not be motivated to substitute alumina for another inorganic filler. Independent claims 14, 30, 31, and 34 of the present application do not require alumina as an inorganic filler.

In addition JP '941 teaches an inorganic filler having 70-97 or 87-97 wt%, not $30 \leq W \leq 60$ as recited in claim 14. Further, JP '941 teaches a phenolic resin having a hydroxyl group, not that the phenolic resin has no hydroxyl group as recited in claims 26, 30, and 34.

JP 09-208808A teaches epoxy resin composition comprising (A) epoxy resin, (B) phenolic resin, (C) during accelerator and (D) inorganic fillers, wherein the resin composition contains at least 83 vol.% of (D) inorganic fillers without a halogen fire retardant (halogen containing flame retardant).

Typically, epoxy resin compositions of examples 1 and 2, as described in paragraphs [0018] & [0019], comprise a biphenyl epoxy resin (epoxy equivalent: 193g/eq.), an aralkylphenol resin (hydroxyl group equivalent: 175g/eq.) and 91 wt% (83 vol.%) and 93 wt% (84 vol.%) of fused spherical silica, respectively. In contrast, epoxy resin composition of comparative examples 1 comprising only 85 wt% (72 vol.%) is poor in flame retardance. The aralkylphenol resin (hydroxyl group equivalent: 175g/eq.) is understood to have a structure of formula (III) as shown in JP '555. The biphenyl epoxy resin (epoxy equivalent: 193g/eq.) is understood to have a structure of formula (I) as shown in JP '555, for example. Accordingly, JP '808 only teaches a phenolic having an hydroxyl group and an inorganic filler > 83 wt% not that the inorganic filler has a wt% W, $30 \leq W \leq 60$ as recited in claim 14, or an inorganic filler with $60 < W \leq 95$ with a phenolic
resin having no hydroxyl group as recited in claim 26, 30, or 34 of the present application.

JP '808 also teaches that (D) inorganic fillers thereof may include Antimony trioxide, and that such a non-halogen containing flame retardant as Antimony trioxide may be contained therein.

The prior art does not disclose anything about a flame retardant epoxy resin composition possessing good flame retardance without the use of flame retardant or flame retarding auxiliary and comprising 60 wt% or less of an inorganic filler. Furthermore, there appears to be strong and clear suggestion that such an epoxy resin composition comprising inorganic fillers in the small content of less than 70 wt% would be poor in flame retardance.

The prior art provides only experimental evidences indicating that epoxy resin compositions comprising one or mixture of epoxy resin having a 4,4'-dihydroxybiphenyl glycidyl ether structure as an epoxy resin, an aralkylphenol resin having a structure of formula (III) as shown in JP '555 as a phenolic resin, and inorganic fillers in the total content of no less than 70 wt% would possess good flame retardance without the use of flame retardant or flame retarding auxiliary. The prior art provides no reasonable suggestion about whether epoxy resin compositions comprising a phenolic resin including biphenyl derivatives having no hydroxyl group such as the phenolbiphenylaralkyl resin of formula (10) and (13), in place of the aralkylphenol resin having a structure of formula (III) as

shown in and JP '555, and inorganic fillers in the total content W of more than 60 wt % ($60 < W \leq 95$) would exhibit good flame retardance without the use of flame retardant or flame retarding auxiliary.

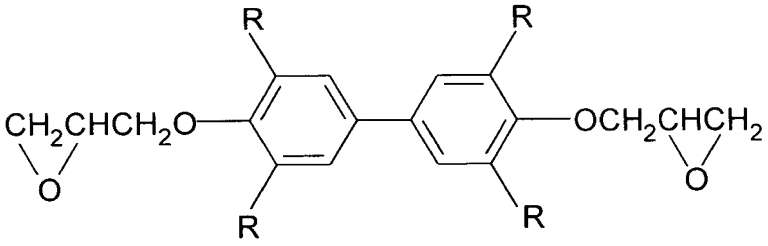
In addition, the examples of epoxy resin compositions possessing good flame retardance without the use of flame retardant or flame retarding auxiliary disclosed in the prior art comprise at least a certain amount of 4,4'-bis(2,3-epoxypropyl)-3,3',5,5'-tetramethlybipenyl of formula (I) shown in JP '555 as an epoxy resin. On the other hand, the references provide no reasonable suggestion about whether epoxy resin compositions comprising no 4,4'-bis(2,3-epoxypropyl)-3,3',5,5'-tetramethly-bipenyl of formula (I), when the compositions contain the inorganic fillers in the total content W of more than 60 wt % ($60 < W \leq 95$), would exhibit good flame retardance without the use of flame retardant or flame retarding auxiliary.

Claims 1-13 are rejected as anticipated by, or in the alternative as obvious over, TOKUNAGA et al. 5,798,400, or TAKAMI et al. 6,054,222, or ENAMI et al. 5,075,357, or Japanese Patent No. 8-301984.

Reconsideration and withdrawal of this rejection are respectfully requested as the references do not disclose or suggest a composition containing an inorganic filler (C) in equal amounts of the content of W (wt%) wherein W (wt%) is selected in range of $30 \leq W \leq 60$ as recited in claim 14 of the present

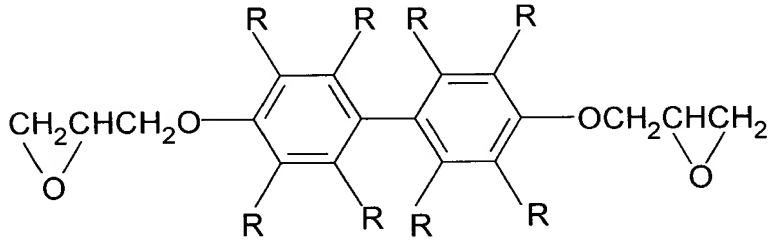
application, or that when $60 < W \leq 95$ that phenolic resin has no hydroxyl group as recited in claims 26, 30, and 34.

TOKUNAGA et al. teach an epoxy resin composition comprising (A) epoxy resin, (B) hardener (phenolic resin), and inorganic fillers comprising (C) silica, wherein (A) epoxy resin contains a biphenyl epoxy resin selected from the group consisting of the formula (I) and (II) below:



(I)

where the R's identically or differently denote hydrogen atoms or monovalent organic groups with 1 to 4 carbons,



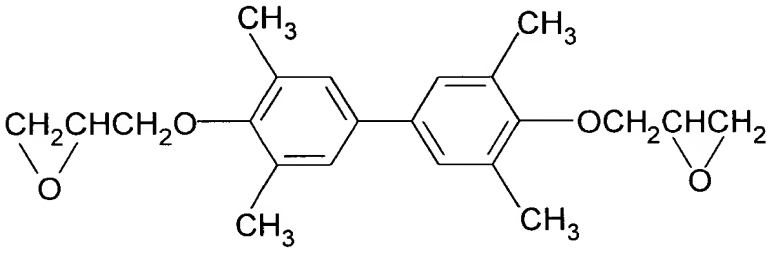
(II)

where the R's identically or differently denote hydrogen atoms or monovalent organic groups with 1 to 4 carbons, (B) hardener (phenolic resin) contains a phenolic resin having at least two phenolic hydroxyl groups and/or naphtholic hydroxyl groups in the molecule, and (C) silica accounts for more than 85 wt% of the total amount of the epoxy resin composition. In addition,

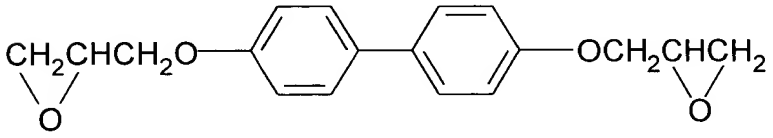
TOKUNAGA et al. suggest that an adequate amount in terms of functionality is such that the ratio of the epoxy equivalent of (A) epoxy resin to the hydroxy equivalent of (B) hardener (phenolic resin) is in the range of 0.7 to 1.3.

Therefore, TOKUNAGA et al. teach nothing about an epoxy resin composition comprising inorganic fillers in the content of less than 70 wt% in the total weight of the epoxy resin composition. TOKUNAGA et al. provide no experimental evidence indicating that examples of epoxy resin compositions listed in Tables 2 to 5 would be good in flame retardance.

For instance, the epoxy resin composition of Example 15 listed in Table 3 comprises 1:1 (by weight) mixture of 4,4'-bis(2,3-epoxypropyl)-3,3',5,5'-tetramethlybipenyl and diglycidyl ether of 4,4'-dihydroxybiphenyl:

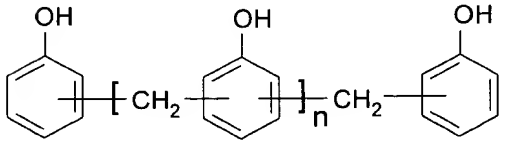


(I)



, as (A) epoxy resin,

a phenolic resin of phenol novolac type:



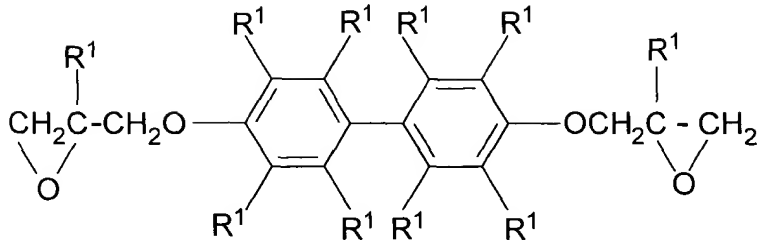
as (B) hardener (phenolic resin), and

silica in the content of 89.2 wt % of the total amount of the epoxy resin composition.

TOKUNAGA et al. also contain such description that examples of (B) hardener (phenolic resin) include phenol aralkyl resin as well as phenol novolac resin. However, TOKUNAGA et al. give no clear suggestion that among examples of phenolic resin described therein, choice of phenolic resin including biphenyl derivatives having no hydroxyl group as recited in claims 26, 30 and 34, such as phenolbiphenylaralkyl resins of formula (10) and (13), is preferred to attain good flame retardancy for an epoxy resin composition comprising inorganic fillers in the content of more than 60 wt% in the total weight of the epoxy resin composition without the use of any flame retardant or flame retarding auxiliary. (See line 38 to 43, column 3).

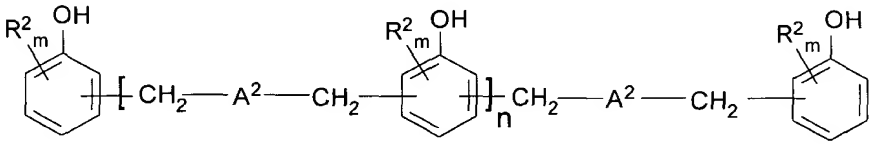
TOKUNAGA et al. suggest further that the epoxy resin composition may be incorporated with a variety of flame retardants and/or flame retardant auxiliary if it is to be used for semiconductor devices which need flame retardance.

TAKAMI et al. teach examples of an epoxy resin composition comprising (A) epoxy resin, (B) curing agent (phenolic resin), (C) cure accelerator and (D) silica (inorganic fillers), wherein (A) epoxy resin is a biphenyl epoxy resin of the formula (1):



(1)

where the R^2's identically or differently denote a hydrogen atom, a monovalent organic group or a halogen atom, (B) curing agent (phenolic resin) is a phenolic resin of general formula (3):



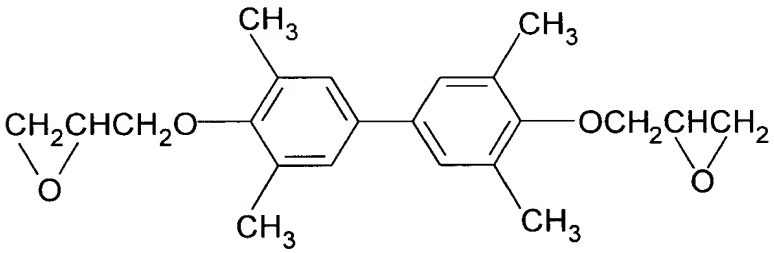
(3)

where the R^2's identically or differently denote hydrogen atoms, monovalent organic groups or halogen atoms; A^2 is a bivalent group selected from those of benzene, biphenyl, naphthalene; m is 0 to 3; and n is 1 to 50, and (D) silica accounts for more than 85 wt% of the total amount of the epoxy resin composition. In addition, Ref. 7 suggests that the ratio of the epoxy equivalent of (A) epoxy resin to the hydroxy equivalent of (B) phenolic resin should be preferably adjusted within the range of 0.5 to 1.5, more preferably of 0.8 to 1.2.

Therefore, TAKAMI et al. teach nothing about an epoxy resin composition comprising inorganic fillers in the content of $30 \leq W \leq 60$ in the total weight of the epoxy resin composition as recited in claim 14 of the present application. TAKAMI et al. provide no experimental evidence indicating that examples of

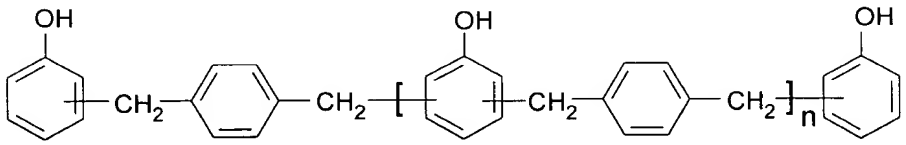
epoxy resin compositions listed in Tables would be good in flame retardance.

For instance, in the epoxy resin composition of Examples listed in Table 1, Epoxy resin I-A of bishydroxybiphenl type epoxy resin with epoxy equivalent of 193 g/eq. and Curing agent I-A of phenol aralkyl resin with hydroxyl equivalent of 170 g/eq. are utilized. The biphenyl epoxy resin I-A (epoxy equivalent: 193g/eq.) is understood to have a structure of formula (I) shown in the reference to SHIMIZU et al., for example:



(I)

The phenol aralkyl resin I-A (hydroxyl equivalent : 170 g/eq.) is understood to have a structure of formula (II) shown in SHIMIZU et al.:



(II)

However, TAKAMI et al. give no clear suggestion that among examples of phenolic resin described therein, choice of phenolic resin including biphenyl derivatives having no hydroxyl group, such as phenolbiphenylaralkyl resins of formula (10) and

(13), is preferred to attain good flame retardancy for an epoxy resin composition comprising inorganic fillers in the content of $60 < W \leq 95$ wt% in the total weight of the epoxy resin composition without the use of any flame retardant or flame retarding auxiliary as recited in claims 26, 30, and 34 of the present application.

ENAMI et al. disclose examples of an epoxy resin composition comprising 100 parts by weight of (A) epoxy resin, a sufficient quantity of (B) curing agent (phenolic resin), from 0.05 to 70 parts by weight of (C) silane coupling agent and from about 30 to about 600 parts by weight of (D) inorganic fillers.

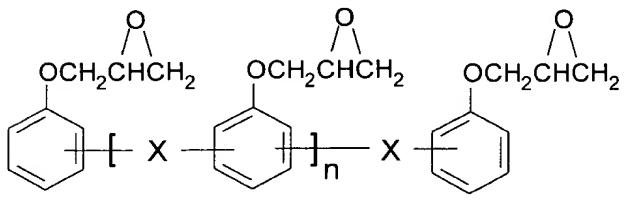
ENAMI et al. teach nothing about how good flame retardance the epoxy resin composition described therein would exhibit. ENAMI et al. provide no experimental evidence indicating that examples of epoxy resin compositions listed in Tables would be good in flame retardance.

For instance, in the epoxy resin composition of Example 1, to 350 parts of fused silica being spray-coated with 1.4 parts silane coupling agent, added were 100 parts cresol novolac-type epoxy resin and 50 parts phenol novolac resin. The epoxy resin composition of Example 1 comprises an inorganic filler in the content of about 68 wt% in the total amount of composition. However, ENAMI et al. give no clear suggestion that in place of the phenol novolac resin described therein, choice of phenolic resin including biphenyl derivatives having no hydroxyl group,

such as phenolbiphenylaralkyl resins of formula (10) and (13), is preferred to attain good flame retardancy for an epoxy resin composition comprising inorganic fillers in the content of 60 < W ≤ 95 wt% in the total weight of the epoxy resin composition without the use of any flame retardant or flame retarding auxiliary as recited in claims 26, 30, and 34 of the present application.

Furthermore, ENAMI et al. has no example of an epoxy resin composition comprising inorganic filler in the content of 60 wt% or less in the total amount of composition. ENAMI et al. give no suggestion to attain good flame retardancy for an epoxy resin composition comprising inorganic fillers in the content of 30 ≤ W ≤ 60 wt% in the total weight of the epoxy resin composition without the use of any flame retardant or flame retarding auxiliary as recited in claim 14 of the present application.

JP 08-301984 teaches an epoxy resin composition comprising (A) epoxy resin, (B) curing agent (phenolic resin) and (C) inorganic filler, wherein (A) epoxy resin contains an epoxy resin (a) of the formula (I):



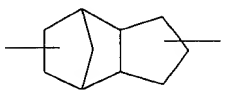
(I)

where n = 0 or 1, and X is a divalent hydrocarbon group having

bicyclo structure, as an essential component, and the epoxy resin composition has an oxygen index of at least 42 % without use of flame retardant or flame retarding auxiliary. Ref. 9 teaches also that the content of (C) inorganic filler in the total weight of the epoxy resin composition should be preferably selected in the range of 80 wt% to 95 wt%. (See Claim 3, and paragraph [0025], column 6).

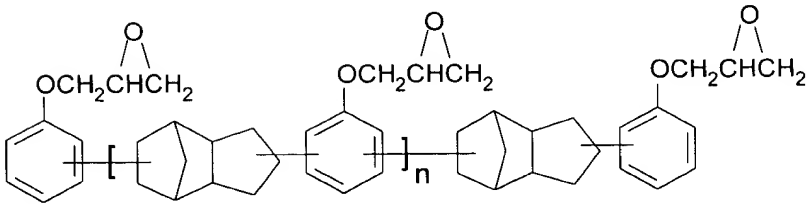
Furthermore, JP '984 suggests clearly that the ratio of the epoxy equivalent of (A) epoxy resin to the hydroxy equivalent of (B) phenolic resin should be preferably adjusted within the range of 0.5 to 1.5, more preferably of 0.8 to 1.2. (See paragraph [0023], column 5). JP '984 recommends also that (A) epoxy resin should contains, in the total epoxy resin amount, preferably 70 wt% or more of an epoxy resin (a) of the formula (I), more preferably 90 wt% or more. (See paragraph [0020], column 5).

Typically, in epoxy resin compositions of examples 3 to 7, as listed in Table 2 on page 7, used are Epoxy resin II of the formula (I) where X is a structure of formula (II) derived from dicylcopentadiene type moiety:

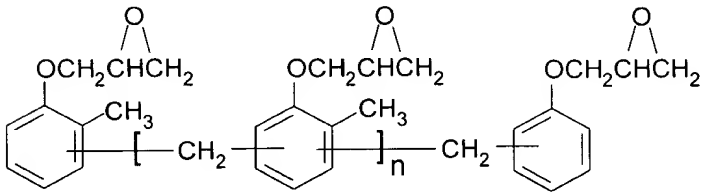


(II)

namely, an epoxy resin with epoxy equivalent of 193 g/eq., shown below

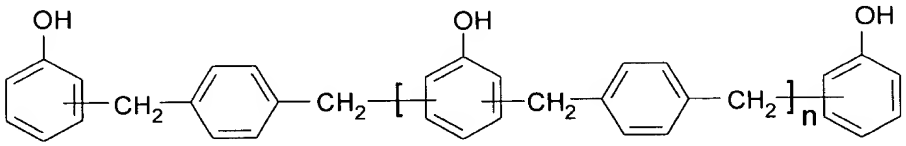


, which is similar to Epoxy resin 6 of formula 6 with epoxy equivalent of 241 g/eq., and Epoxy resin I of ortho-cresol novolac type with epoxy equivalent of 200 g/eq., which is very similar to Epoxy resin 5 of formula (5) with epoxy equivalent of 194 g/eq.:

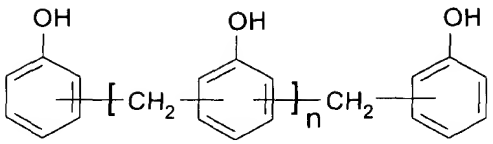


(5)

; and, as for (B) curing agent (phenolic resin), used are Curing agent II of an aralkyl phenol resin:



where those fractions in which n in 1-3 account for about 90 wt%, which is good corresponding to phenolic resin 1 of formula (9) (hydroxyl group equivalent : 175 g/eq.) of the present application, and Curing agent I of phenol novolac resin with hydroxyl group equivalent of 107 g/eq., which is very corresponding to phenolic resin 3 of formula (11) (hydroxyl group equivalent : 106 g/eq.):



(11)

Accordingly, JP '984 gives no suggestion about a flame retardant epoxy resin composition possessing good flame retardance without the use of flame retardant or flame retarding auxiliary and comprising $30 \leq W \leq 60$ wt% of an inorganic filler as recited in claim 14 of the present application. Furthermore, there appears to be considerable expectation that such an epoxy resin composition comprising inorganic fillers in the small content of 60 wt% or less would be poor in flame retardance.

JP '984 provides only experimental evidences indicating that epoxy resin compositions comprising a dicylcopentadiene epoxy resin mentioned above, as major component of epoxy resin, an aralkylphenol resin corresponding to formula (9) and/or phenol novolac resin corresponding to formula (11), as a phenolic resin, and inorganic fillers in the total content of no less than 80 wt% would possess good flame retardance without the use of flame retardant or flame retarding auxiliary. JP '984 gives no reasonable suggestion about whether epoxy resin compositions comprising no epoxy resin of formula (I) having bicyclo-structure, and a phenolic resin including biphenyl derivatives having no hydroxyl group such as the phenolbiphenylaralkyl resin of formula (10) and (13), in place of the aralkylphenol resin corresponding to formula (9) and/or phenol novolac resin

corresponding to formula (11), with inorganic fillers in the total content W of more than 60 wt % ($60 < W \leq 95$), as recited in claims 26, 30, and 34 would exhibit good flame retardance without the use of flame retardant or flame retarding auxiliary.

In addition, there is no motivation in JP '984 to replace an epoxy resin of formula (I) having bicyclo-structure completely with other epoxy resin.

The prior art does not disclose anything about a flame retardant epoxy resin composition possessing good flame retardance without the use of flame retardant or flame retarding auxiliary and comprising 60 wt% or less of an inorganic filler. Furthermore, there appears to be strong and clear suggestion that such an epoxy resin composition comprising inorganic fillers in the small content of less than 70 wt% would be poor in flame retardance.

The prior art provides no experimental evidence (example) for any epoxy resin compositions comprising only a phenolic resin including biphenyl derivatives having no hydroxyl group such as the phenolbiphenylaralkyl resin of formula (10) and (13), as a curing agent (phenolic resin), and inorganic fillers in the total content W of more than 60 wt % ($60 < W \leq 95$). Therefore, the prior art gives no reasonable suggestion about whether epoxy resin compositions comprising only a phenolic resin including biphenyl derivatives having no hydroxyl group such as the phenolbiphenylaralkyl resin of formula (10) and (13), in

place of the aralkylphenol resin corresponding to formula (9) and/or phenol novolac resin corresponding to formula (11), with inorganic fillers in the total content W of more than 60 wt % ($60 < W \leq 95$) would exhibit good flame retardance without the use of flame retardant or flame retarding auxiliary.

The combination of references cited in the Official Action neither disclose or suggest either an inorganic filler wherein the W (wt%) is selected in the range of $30 \leq W \leq 60$ as recited in claim 14 of the present application or that the inorganic filler (C) has a W (wt%) selected in the range of $60 < W < 95$ and that the phenolic resin (B) is one or a mixture of two or more phenolic resins containing biphenyl derivatives having no hydroxyl group in the molecule as recited in independent claims 26, 30, and 34.

Claims 15-25, 27-29, 31-33, and 35-43 depend from one of claims 14, 26, 30, and 34, and further define the invention and are also believed patentable over the cited prior art.

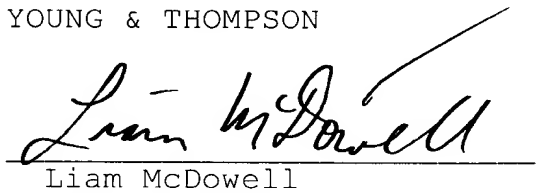
Accordingly, it is believed that the new claims void the rejections under §102 and §103 and are allowable over the art of record.

In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

Attached hereto is a marked-up version of the changes made to the abstract. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

YOUNG & THOMPSON

By 

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May 22, 2003

ABSTRACT OF THE DISCLOSURE

--An epoxy resin composition which can be used as a semiconductor encapsulating resin and in which the improvement of flame retardancy can be attained by suitably adapting a crosslinked structure itself of a cured article without using any flame retardant material and without particularly highly filling an inorganic filler. The epoxy resin composition includes an epoxy resin (A), a phenolic resin (B), an inorganic filler (C) and a curing accelerator (D), wherein a flexural modulus E (kgf/mm^2) at 240 ± 20%C of a cured article obtained by curing the composition is a value satisfying $0.015W + 4.1 \leq E \leq 0.27W + 21.8$ in the case of $30 \leq W < 60$, or a value satisfying $0.30W - 13 \leq E \leq 3.7W - 184$ in the case of $60 \leq W \leq 95$ wherein W (wt%) is a content of the inorganic filler (C) in the cured article. The cured article of this composition forms a foamed layer during thermal decomposition or at ignition to exert flame retardancy.--

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The Abstract of the Disclosure was amended as follows:

--[An object of the present invention is to provide an] An epoxy resin composition which can be used as a semiconductor encapsulating resin and in which the improvement of flame retardancy can be attained by suitably adapting a crosslinked structure itself of a cured article [of the above composition] without using any flame retardant material and without particularly highly filling an inorganic filler. The [present invention provides an] epoxy resin composition [comprising] includes an epoxy resin (A), a phenolic resin (B), an inorganic filler (C) and a curing accelerator (D), wherein a flexural modulus E (kgf/mm^2) at 240 ± 20%C of a cured article obtained by curing the composition is a value satisfying $0.015W + 4.1 \leq E \leq 0.27W + 21.8$ in the case of $30 \leq W < 60$, or a value satisfying $0.30W - 13 \leq E \leq 3.7W - 184$ in the case of $60 \leq W \leq 95$ wherein W (wt%) is a content of the inorganic filler (C) in the cured article. The cured article of this composition forms a foamed layer during thermal decomposition or at ignition to•exert flame retardancy.

[[Selected Drawing] Fig. 1]--